

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) An inorganic polymer matrix composition, binder composition, or foam composition, comprising: the reaction product of an alkali silicate, one or more non-silicate oxoanionic compounds or a reactive acidic glass, or combinations thereof; water; and a reinforcing media comprising fibers, fabrics, or microspheres, or combinations thereof; and optionally one or more additives; and optionally one or more network modifiers.

2. (Currently Amended) An inorganic polymer matrix composition, binder composition, or foam composition, comprising: the reaction product of an alkali base; a silica source; and one or more non-silicate oxoanionic compounds or a reactive glass, or combinations thereof; water; and a reinforcing media comprising fibers, fabrics, or microspheres, or combinations thereof; optionally one or more network modifiers; and optionally one or more fillers.

3. (Cancelled).

4. (Previously Amended) The composition of claim 1, wherein said network modifiers comprises a cation.

5. (Currently Amended) The composition of claim 4, wherein said cation is a multivalent cation ~~selected from~~ comprising Groups 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, or 16 of the Periodic Table.

6. (Original) The composition of claim 4, wherein said cation is an alkaline earth cation.

7. (Previously Amended) The composition of claim 1, wherein said non-silicate oxoanionic compound comprises an acidic oxoanionic compound.

8. (Original) The composition of claim 7, wherein said acidic oxoanionic compound comprises boric acid, phosphoric acid, sulfuric acid, sodium dihydrogen phosphate, disodium hydrogen phosphate, dipotassium hydrogen phosphate, potassium dihydrogen phosphate, ammonium hydrogen phosphate, ammonium dihydrogen phosphate, metallic and/or nonmetallic phosphate salts or compounds incorporating borate, sulfate, aluminate, vanadate, germanate, or combinations thereof.

9. (Previously Amended) The composition of claim 1, wherein said non-silicate oxoanionic compound comprises a non-acidic oxoanionic compound.

10. (Original) The composition of claim 9, wherein said non-acidic oxoanionic compound comprises trisodium phosphate, potassium phosphate, or sodium borate.

11. (Previously Amended) The composition of claim 1, wherein said non-silicate oxoanionic compound comprises a mixture of potassium dihydrogen phosphate and boric acid; sodium dihydrogen phosphate and boric acid; potassium dihydrogen phosphate, sodium dihydrogen phosphate and boric acid; or sodium borate and potassium dihydrogen phosphate.

12. (Previously Amended) The composition of claim 1, wherein said non-silicate oxoanionic compound comprises monobasic potassium phosphate and boric acid.

13. (Original) The composition of claim 7, wherein said acidic oxoanionic compound is present in an amount of between about 0.01 wt. % and 20 wt. % based upon the total composition.

14. (Currently Amended) The composition of claim 1, wherein said reactive glass can be characterized by the following formula:



where A' represents at least one alkali metal glass modifier, G_f represents at least one glass former, A'' represents, optionally, at least one glass network modifier, a represents the number of fluxing agents present and [[can]] ranges from 1 to 5, g

represents the number of glass formers present and $[[c]]$ ranges from 1 to 10, c represents the number of glass network modifiers and $[[c]]$ ranges from 0 to about 30, x represents the mole fraction of fluxing agent and is between about 0.050 and about 0.150, y represents the mole fraction of glass former and is between about 0.200 and about 0.950, z represents the mole fraction of glass network modifiers and is between about 0.000 and about 0.500, $x + y + z = 1$, and $x < y$.

15. (Original) The composition of claim 14, wherein said alkali glass modifier comprises lithium, sodium, potassium, rubidium, cesium or combinations thereof.

16. (Previously Amended) The composition of claim 15, wherein said glass former comprises boron, silicon, phosphorus, sulfur, germanium, arsenic, antimony, aluminum, vanadium or combinations thereof.

17. (Previously Amended) The composition of claim 16, wherein said glass network modifier comprises, titanium, chromium, manganese, iron, cobalt, nickel, copper, mercury, zinc, lead, zirconium, lanthanum, cerium, praseodymium, neodymium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, actinium, thorium, uranium, yttrium, gallium, magnesium, calcium, strontium, barium, tin, bismuth, cadmium, or combinations thereof.

18. (Original) The composition of claim 1, wherein said optional additives comprise clay fillers, oxide fillers, gel modifiers, organic toughening agents, or plasticizing agents or combinations thereof.

19. (Original) The composition of claim 18, wherein said fillers comprise kaolin, metakaolin, montmorillonites or mica or combinations thereof.

20. (Original) The composition of claim 18, wherein said oxide filler is magnesium oxide, zinc oxide or calcium oxide or combinations thereof.

21. (Currently Amended) The composition of claim 18, wherein said gel modifier is an organic acid or base comprising hydroxyacids, $[[N]]$ nitrogen- $[[based]]$ containing bases, or $[[P]]$ phosphorus- $[[based]]$ containing bases, or combinations thereof.

22. (Previously Amended) The composition of claim 18, wherein said gel modifier comprises α -hydroxyacids, β -hydroxyacids, substituted pyridines, quinolines or combinations thereof.

23. (Cancelled).

24. (Currently Amended) The composition of claim 1, wherein said reinforcing fibers comprise nickel fibers, nickel-coated carbon fibers, nickel-coated graphite fibers, glass fibers, carbon fibers, graphite fibers, mineral fibers, oxidized carbon fibers, oxidized graphite fibers, steel fibers, metallic fibers, metal-coated carbon fibers, metal-coated glass fibers, metal-coated graphite fibers, metal-coated ceramic fibers; quartz fibers, ceramic fibers, silicon carbide fibers, stainless steel fibers, titanium fibers, nickel alloy fibers, polymeric fibers, aramid fibers, basalt fibers, alkaline resistant glass fibers or combinations thereof.

25. (Previously Amended) The composition of claim 1, wherein said fibers possess an oxophilic surface.

26. (Previously Amended) The composition of claim 1, wherein said fibers are coated to enhance oxophilicity.

27. (Previously Amended) The composition of claim 1, wherein said fibers are in the form of yarns, tows, whiskers, continuous fibers, short fibers, woven fabrics, knitted fabrics, non-woven fabrics, random mats, felts, braided fabrics, or wound tows.

28. (Currently Amended) A matrix, binder, or foam composition₁ comprising:



wherein:

$A = (1-z) K_2O$ or $(z)Na_2O$, where z ~~can vary~~ varies between 0 and 1, K_2O is potassium oxide, and Na_2O is sodium oxide; Li_2O ~~can be added if desired is~~ optionally added.

SiO_2 is silica or a combination of various silicas;

H_2O is water;

a = molar ratio of A_2O : SiO_2 , which ranges from 0.05 to 1.0,

b = molar ratio of B : SiO_2 , which ranges from 0.001 to 0.500,

c = molar ratio of C : SiO_2 , which ranges from 0.0 to 0.250,

d = is the molar ratio of D : SiO_2 and ranges from 0.0 to 2.000,

n = molar ratio of H_2O incorporated into the formulation, for which during initial formulation which ranges from 0.10 to 0.90,

x = the number of additives (D) used to aid in processing and performance of the basic formulation and ranges from 0 to 20,

B = non-silicate oxoanionic compound or a reactive acidic glass, or combinations thereof,

C = network modifiers such as Mg^{2+} , Ca^{2+} , Zn^{2+} , Al^{3+} , Ti^{4+} derived from multivalent main group metal and/or transition metal compounds, such as $Mg(NO_3)_2$, $ZnCl_2$, or a combination thereof or as a metallic component of a reactive glass, and

D = optional additives selected from ~~one or more, alone or in combination,~~
the group consisting of

- (i) reactive fillers or nonreactive fillers or combinations thereof;
- (ii) gelation modifiers;
- (iii) a surface-active agents selected from the group consisting of an anionic, cationic or nonionic surfactants or combinations thereof; and
- (iv) organic-~~[[based]]~~ containing toughening agents or plasticizing agents or combinations thereof, and

a reinforcing media comprising fibers, fabrics, or microspheres, or combinations thereof.

29. (Previously Amended) The composition of claim 28, wherein said non-silicate oxoanionic compound comprises phosphate, sulfate, or borate groups.

30. (Previously Amended) The composition of claim 28, wherein said non-silicate oxoanionic compound is derived from an acidic precursor.

31. (Original) The composition of claim 30, wherein said acidic precursor comprises H_3PO_4 , H_2SO_4 , H_3BO_3 or a combination thereof.

32. (Previously Amended) The composition of claim 31 wherein said acidic precursor comprises salts derived from H_3PO_4 , H_2SO_4 , H_3BO_3 or a combination thereof.

33. (Previously Amended) The composition of claim 30, wherein said reactive glass comprises an alkali borophosphate or an alkali phosphoborate glass or combinations thereof.

34. (Currently Amended) The composition of claim 30, wherein said surface active agents comprise alkylaryl sulfonates, quaternary ammonium salts, protonated organoamine salts, hydroxy polymers, organosilicones ~~organic-inorganic hybrids such as silicones~~, or combinations thereof.

35 (Previously Amended) The composition of claim 30, wherein said fillers comprise kaolin, smectites, hornites, mica, vermiculite, metakaolin, metal oxides or a combination thereof.

36. (Currently Amended) The composition of claim 30, wherein said organic ~~[[based]] -containing~~ toughening agents are comprised of resins, low molecular weight ~~polymers oligomers having a weight average molecular weight of less than 1,000~~, or high molecular weight polymers having a weight average molecular weight of from 1,000 to 10,000,000, or a combination thereof.

37. (Previously Amended) The composition of claim 30, wherein said gelation modifiers comprise an organic base or an organic acid or a combination thereof.

38. (Original) The composition of claim 37, wherein said organic base is quinoline.

39. (Original) The composition of claim 37, wherein said organic acid is lactic acid or citric acid or a combination thereof.

40. (Previously Amended) The composition of claim 1 wherein said polymer matrix, or binder, or foam, is coated with a solution to enhance thermal stability or hydrolytic stability or a combination thereof.

41. (Original) The composition of claim 40, wherein said solution is a solution of phosphoric acid.

42. (Original) The composition of claim 40, wherein said solution is a solution of phosphoric acid and one or more metallic salts.

43. (Original) The composition of claim 40, wherein said solution is a solution of a magnesium salt and phosphoric acid.

44. (Previously Amended) The composition of claim 40, wherein said solution contains a polyvalent metallic salt comprising aluminum, calcium, zinc, cerium, lanthanum, or combinations thereof.

45. (Previously Amended) The composition of claim 40, wherein said solution contains a polyvalent metallic salt comprising aluminum, calcium, zinc, cerium, lanthanum or phosphoric acid.

46. (Previously Amended) The composition of claim 40, wherein said solution contains a monovalent metallic salt comprising lithium hydroxide, lithium acetate, or lithium chloride.

47. (Previously Amended) The composition of claim 30, wherein said matrix, or binder, or foam, is coated with a solution to enhance thermal or hydrolytic stability.

48. (Previously Amended) The composition of claim 28, wherein said matrix, or binder, or foam, is coated with a solution to enhance the thermal and hydrolytic stability.

49. (Original) The composition of claim 48, wherein said solution is a solution of phosphoric acid.

50. (Original) The composition of claim 48, wherein said solution is a solution of phosphoric acid and one or more metallic salts.

51. (Original) The composition of claim 47, wherein said solution is a solution of a magnesium salt and phosphoric acid.

52. (Previously Amended) The composition of claim 47, wherein said solution contains a polyvalent metallic salt comprising aluminum, calcium, zinc, cerium, or lanthanum, or combinations thereof.

53. (Previously Amended) The composition of claim 47, wherein said solution contains a polyvalent metallic salt comprising aluminum, calcium, zinc, cerium, or lanthanum, or phosphoric acid, or combinations thereof.

54. (Previously Amended) The composition of claim 48, wherein said solution contains a monovalent metallic salt comprising lithium hydroxide, lithium acetate, or lithium chloride.

55. (Previously Amended) The composition of claim 1 comprising said polymer matrix, binder, or foam, and said reinforcement having an enhanced level of mechanical strength where the reinforcement exhibits an oxophilic character at the interface formed between the polymer matrix and reinforcement.

56. (Previously Amended) The composition of claim 1 comprising said polymer matrix, binder, or foam, and a graphite and carbon reinforcement having an enhanced level of mechanical strength due to an improved interface formed between the polymer matrix and reinforcement, wherein said reinforcement is treated by chemical oxidation.

57. (Previously Amended) The composition of claim 1 comprising said polymer matrix, binder, or foam, and a graphite and carbon reinforcement having an enhanced level of mechanical strength due to the interface formed between the polymer matrix and reinforcement, wherein said reinforcement is treated by thermal oxidation.

58. (Previously Amended) The composition of claim 8 comprising said polymer matrix, or binder, or foam, and a graphite or carbon reinforcement having an enhanced level of mechanical strength due to an improved interface formed between

the polymer matrix and reinforcement, wherein said reinforcement is treated by chemical oxidation.

59. (Previously Amended) The composition of claim 8 comprising said polymer matrix, binder, or foam, and a graphite or carbon reinforcement having an enhanced level of mechanical strength due to the interface formed between the polymer matrix and reinforcement, wherein said reinforcement is treated by thermal oxidation.

60. (Previously Amended) The composition of claim 1 comprising said polymer matrix, binder, or foam, and said reinforcement having an enhanced level of mechanical strength due to the interface formed between the polymer matrix and reinforcement, wherein said reinforcement is treated by metallization.

61. (Previously Amended) The composition of claim 1 comprising said polymer matrix, binder, or foam, and a graphite and carbon reinforcement having an enhanced level of mechanical strength due to the interface formed between the polymer matrix and reinforcement, wherein said reinforcement is treated by electrolytic oxidation.

62. (Previously Amended) The composition of claim 8 comprising said polymer matrix, or binder, or foam, and a graphite or carbon reinforcement having an enhanced level of mechanical strength due to the interface formed between the polymer matrix and reinforcement, wherein said reinforcement is treated by electrolytic oxidation.

63. (Previously Amended) The composition of claim 1 comprising said polymer matrix, binder, or foam, and said reinforcement having improved interfacial strength.

64. (Original) A composition of claim 55, wherein said oxophilic character is the result of a sizing applied to the reinforcement.

65. (Original) A composition according to claim 64, wherein said sizing is an organic-inorganic hybrid sizing.

66. (Original) A composition according to claim 64, wherein said sizing comprises an organic polymer and an inorganic oxide particulate.

67. (Original) A composition according to claim 64, wherein said sizing comprises polyvinyl alcohol and silica.

68. (Original) A composition according to claim 64, wherein said sizing comprises an epoxy and glass frit.

69. (Original) A composition according to claim 64, wherein said sizing comprises an epoxy and a reactive glass frit.

70. (Original) A composition according to claim 64, wherein said sizing comprises polyvinyl alcohol and a reactive glass frit.

71. (Previously Amended) The composition of claim 1 comprising said polymer matrix, or binder, or foam, and said reinforcement having an enhanced level of mechanical strength due to the interface formed between the polymer matrix and the reinforcement, wherein said reinforcement has an irregular or roughened surface or a combination thereof.

72. (Previously Amended) An inorganic polymer matrix, binder, or reinforced or non-reinforced foam composition comprising an alkali silicate, and a reactive boron containing glass.

73. (Previously Amended) An inorganic polymer matrix, binder, or reinforced or non-reinforced foam of claim 72 wherein said reactive glass comprises an acidic phosphoborate glass.

74. (Previously Amended) An inorganic polymer matrix, binder, or reinforced or non-reinforced foam of claim 72 wherein said reactive glass comprises an acidic borophosphate glass.

75. (Previously Amended) An inorganic polymer matrix, binder, or reinforced or non-reinforced foam of claim 72 wherein said reactive glass comprises an acidic phosphoborate and acidic borophosphate glass.

76. (Previously Amended) An inorganic polymer matrix, binder, or reinforced or non-reinforced foam composition comprising an alkali silicate and potassium dihydrogen phosphate.

77. (Previously Amended) The composition of claim 8 comprising said alkali silicate, and wherein the reinforcement exhibits an oxophilic character at the interface formed between the polymer matrix and reinforcement.

78. (Previously Amended) The composition of claim 8 comprising said alkali silicate, and wherein the reinforcement exhibits an oxophilic character at the interface formed between the polymer matrix and reinforcement wherein said reinforcement is treated by metallization.

79. (Previously Amended) The composition of claim 14 comprising a carbon or graphite reinforcement and said alkali silicate wherein the reinforcement exhibits an oxophilic character at the interface formed between the polymer matrix and reinforcement wherein said reinforcement wherein said reinforcement is treated by chemical oxidation.

80. (Previously Amended) The composition of claim 14 comprising a carbon or graphite reinforcement and said alkali silicate wherein the reinforcement exhibits an oxophilic character at the interface formed between the polymer matrix and reinforcement wherein said reinforcement wherein said reinforcement is treated by thermal oxidation.

81. (Previously Amended) The composition of claim 14 comprising a carbon or graphite reinforcement and said alkali silicate wherein the reinforcement exhibits an oxophilic character at the interface formed between the polymer matrix and reinforcement wherein said reinforcement wherein said reinforcement is treated by electrolytic oxidation.

82. (Previously Amended) The composition of claim 1 comprising said alkali silicate, wherein the reinforcement exhibits an oxophilic character at the interface between the matrix, binder, or foam and the reinforcement as a result of the application of sizing to the reinforcement.

83. (Original) A composition according to claim 82, wherein said sizing comprises an organic polymer and an inorganic oxide particulate.

84. (Original) A composition according to claim 82, wherein said sizing comprises polyvinyl alcohol and silica.

85. (Original) A composition according to claim 82, wherein said sizing comprises epoxy and glass frit.

86. (Original) A composition according to claim 82, wherein said sizing comprises epoxy and a reactive glass frit.

87. (Original) A composition according to claim 82, wherein said sizing comprises polyvinyl alcohol and a reactive glass frit.

88. (Original) A composition according to claim 82, wherein the reinforcement comprises carbon fibers, graphite fibers or combinations thereof.

89. (Original) A composition according to claim 71, wherein the reinforcement comprises glass.

90. (Previously Amended) A reinforced inorganic polymer matrix, binder, or foam composition comprising a reinforcement and an alkali silicate wherein the reinforcement exhibits an oxophilic character at the interface between the matrix and the reinforcement as a result of a sizing comprising polyvinyl alcohol being applied to the reinforcement.

91. (Previously Amended) A reinforced inorganic polymer matrix, binder, or foam composition comprising a reinforcement and an alkali silicate and wherein the reinforcement exhibits an oxophilic character at the interface between the matrix and the reinforcement as a result of a primer comprising polyvinyl alcohol being applied to the reinforcement.

92. (Previously Amended) A reinforced inorganic polymer matrix, binder, or foam composition comprising a reinforcement and an alkali silicate wherein the reinforcement exhibits an oxophilic character at the interface between the matrix and the reinforcement as a result of polyvinyl alcohol being applied to the composition.

93. (Previously Amended) A reinforced inorganic polymer matrix, binder, or foam composition comprising reinforcement and an alkali silicate wherein the reinforcement exhibits an oxophilic character at the interface between the matrix and the reinforcement as a result of a sizing comprising crosslinked polyvinyl alcohol being applied to the reinforcement.

94. (Previously Amended) A reinforced inorganic polymer matrix, binder, or foam composition comprising a reinforcement and an alkali silicate wherein the reinforcement exhibits an oxophilic character at the interface between the matrix and the reinforcement as a result of a primer comprising crosslinked polyvinyl alcohol being applied to the reinforcement.

95. (Previously Amended) A reinforced inorganic polymer matrix, binder, or foam composition containing a reinforcement comprising a reaction product of an alkali silicate and a phosphoborate glass, wherein the reinforcement exhibits an oxophilic character at the interface between the matrix and reinforcement.

96. (Original) A glass composition comprising about 10 mol % to about 50 mol % of phosphorus pentoxide or its salts, acids or precursor forms; about 10 mol % to about 70 mol % of boron oxide; about 5 mol % to about 45 mol % of an alkali oxide and from about 0 mol % to about 30 mol % of an alkaline earth oxide.

97. (Original) A glass composition comprising about 20 mol % to about 40 mol % of phosphorus pentoxide or its salts, acids or precursor forms; about 30 mol % to about 60 mol % of boron oxide; about 20 mol % to about 40 mol % of an alkali oxide and from about 5 mol % to about 20 mol % of an alkaline earth oxide.

98. (Original) A glass composition comprising about 25 mol % to about 35 mol % of phosphorus pentoxide or its salts, acids or precursor forms; about 45 mol % to about 55 mol % of boron oxide; about 15 mol % to about 30 mol % of an alkali oxide and from about 10 mol % to about 15 mol % of an alkaline earth oxide.

99.–101. (Cancelled).

102. (Previously Amended) A reinforced inorganic polymer matrix, binder, or reinforced or non-reinforced foam composition containing a reinforcement

comprising a reaction product of an alkali silicate and the glass composition of claim 96, wherein the reinforcement exhibits an oxophilic character at the interface between the matrix and reinforcement.

103. (Previously Amended) A reinforced inorganic polymer matrix, binder, or reinforced or non-reinforced foam composition containing a reinforcement comprising a reaction product of an alkali silicate and the glass composition of claim 97, wherein the reinforcement exhibits an oxophilic character at the interface between the matrix and reinforcement.

104. (Previously Amended) A reinforced inorganic polymer matrix, binder, or reinforced or non-reinforced foam composition containing a reinforcement comprising a reaction product of an alkali silicate and the glass composition of claim 98, wherein the reinforcement exhibits an oxophilic character at the interface between the matrix and reinforcement.

105.-106. (Cancelled).